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**Title:** Report to NCSP on FY22 DANCE and NEUANCE measurements of 233U(n, )

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# Report to NCSP on FY22 DANCE and NEUANCE measurements of $^{233}\mathrm{U}(n,\gamma)$

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## 1 Experimental measurement 2020-2021

The experiment was performed at the end of the CY20 runcycle and CY21. A total of 20 days were measured using the 20 mg sample, and the 10 mg sample was placed in the beam for a total of 2 days. The rest of the beam time was used to measure radioactive $\gamma$ sources for energy calibration, background measurements, and tests to define the $^{233}$U windows required during the data taking.

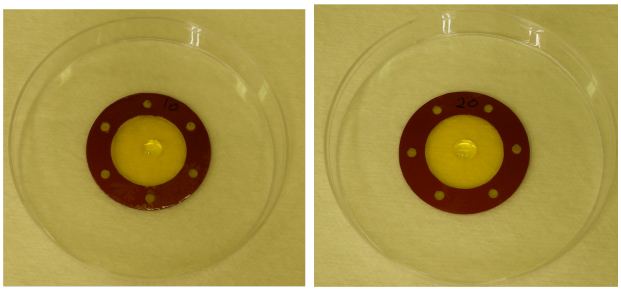

Figure 1: The $^{233}$U samples preparation. The 10 mg sample is shown on the left and the 20 mg sample on the right.

## 2 Fission tagging

After calibrating the DANCE and NEUANCE detectors, the analysis code was modified to search for coincidences between the DANCE and NEUANCE channels. First, a time window of 5ns was used to look for $\gamma$s coincidences between the DANCE crystals to search for $\gamma$ cascades. Then, a time window of 25ns was used to look for coincidences between the $\gamma$s from DANCE and the neutrons from NEUANCE. The events from DANCE found in coincidence with NEUANCE have been tagged as fission events and the rest of the DANCE events have been left untagged. The purpose of tagging is to define the shape of the fission $\gamma$-ray spectrum that can be subtracted from the untagged spectrum. The tagged histogram in figure 2 have been normalized to the untagged histogram in the region with multiplicity higher than 12, where fission dominates.

The neutron scattering background has been studied using a $^{208}$Pb sample. The preliminary histograms of the energy of the crystals for multiplicities between 3 and 6 and neutron energies between 1 eV and 100 eV, for the untagged, normalized tagged, the difference between them and the scatter are shown in figure

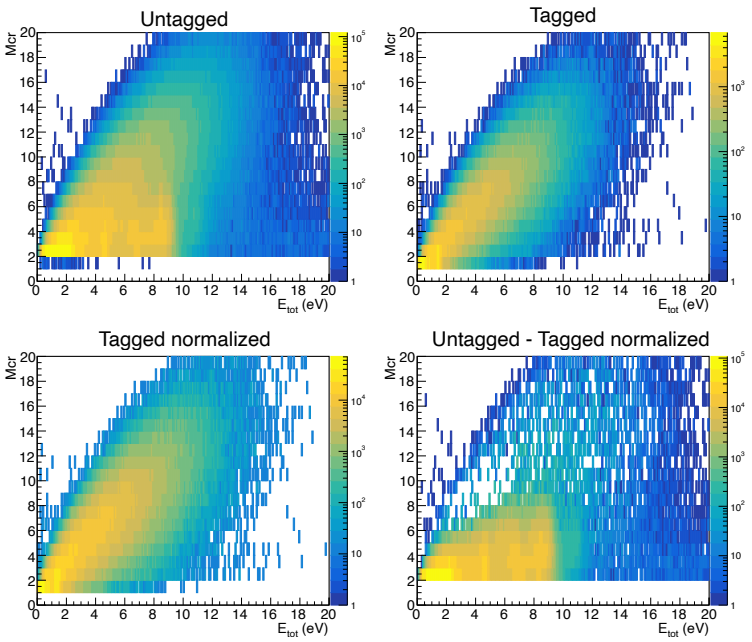


Figure 2: Crystal multiplicity as a function of the total energy of the crystals for the untagged events (top left), tagged events (top right), normalized tagged events (bottom left) and the difference between the untagged and the normalized tagged events (bottom right).

3. This background subtraction method will be applied bin by bin over the full neutron energy spectrum because all the background components are energy dependent.

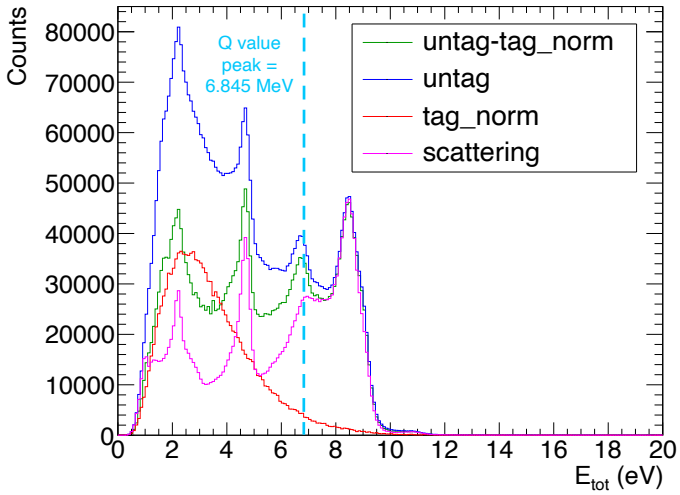


Figure 3: Preliminary histograms of the energy of the crystals for neutron energies from (1,100) eV and multiplicity from (3,6) for 1 hour of data taking.

## 3 Conclusions and next steps

The total of the experimental data have been collected in two measurements in 2020 and 2021. The complete set of experimental data is being analyzed. The fission tagging method has being succesfully implemented in

the code, and the background studies are been performed. The data analysis will continue during the year 2022 and the results will be provided by the end of FY22.